

IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his )  
capacity as ATTORNEY GENERAL )  
OF THE STATE OF OKLAHOMA and )  
OKLAHOMA SECRETARY OF THE )  
ENVIRONMENT C. MILES TOLBERT, )  
in his capacity as the )  
TRUSTEE FOR NATURAL RESOURCES )  
FOR THE STATE OF OKLAHOMA, )

Plaintiff, )

vs. )

4:05-CV-00329-TCK-SAJ

TYSON FOODS, INC., et al, )

Defendants. )

- - - - -

VOLUME II OF THE VIDEOTAPED  
DEPOSITION OF DENNIS COOKE, PhD, produced as a  
witness on behalf of the Defendants in the above  
styled and numbered cause, taken on the 5th day of  
December, 2008, in the City of Tulsa, County of  
Tulsa, State of Oklahoma, before me, Lisa A.  
Steinmeyer, a Certified Shorthand Reporter, duly  
certified under and by virtue of the laws of the  
State of Oklahoma.

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**EXHIBIT**

**4**

<p>1 Q — good morning. I'm going to try to pick up 2 where I left off yesterday. Is the trophic state of 3 Lake Tenkiller getting better or worse over time in 4 recent years?</p> <p>5 A It certainly is not getting better. It looks 08:29AM 6 as if it's maintained what we would call eutrophic 7 condition, with the exception of the LK-04 station, 8 which every year seems to have more phosphorus in 9 it, with some exceptions. There's years where 10 there's less water flowing in. Then these 08:30AM 11 concentrations fall as you predict.</p> <p>12 Q How can you tell it's getting worse; what are 13 you basing that on?</p> <p>14 A Worse being higher concentrations.</p> <p>15 Q Of what? 08:30AM</p> <p>16 A I'm sorry. Of total phosphorus and also of 17 chlorophyll, and we can see this in the figures of 18 our report.</p> <p>19 Q Well, how many indicators of trophic state are 20 available to you as a limnologist for use? 08:30AM</p> <p>21 A We use transparency, total phosphorus, 22 chlorophyll, the kinds of phytoplankton you find in 23 the water and dissolved oxygen loss, and those are 24 the central ones that are used by convention and, of 25 course, this is really how the lake responds. So 08:31AM</p> <p style="text-align: center;">318</p>	<p>1 '93?</p> <p>2 A It hasn't changed a lot.</p> <p>3 Q How much of the differences in total 4 phosphorus concentration in Lake Tenkiller between 5 1993 and 2007, which I think are shown on your 08:32AM 6 Figure 7, would be attributable to differences in 7 residence time as opposed to being attributable to 8 changes in total phosphorus loading or biological 9 uptake?</p> <p>10 A Well, biological uptake would not influence 08:33AM 11 this because it's called total phosphorus. It means 12 that the procedure that's used to determine it also 13 includes digesting all biological material that 14 would be in the sample to total phosphorus, so I can 15 exclude that. The difference or how much of this is 08:33AM 16 attributable to water residence time in 17 concentration, I'm not sure I'd know exactly how to 18 calculate that. The two work together. In other 19 words, if we had really low concentration coming in 20 and very high water residence time, we would have a 08:33AM 21 different response in the reservoir and we don't 22 have that here. We have high concentration and high 23 residence time, so that makes concentration.</p> <p>24 Q How much of the difference in total phosphorus 25 concentration in Lake Tenkiller between 1993 and 08:33AM</p> <p style="text-align: center;">320</p>
<p>1 almost everyone uses those.</p> <p>2 Q Well, what are the pros and cons of using 3 total phosphorus versus chlorophyll versus Seki 4 depth for assessing the trophic state of a 5 reservoir? 08:31AM</p> <p>6 A These are linked. Chlorophyll and total 7 phosphorus are strongly correlated and as is 8 chlorophyll and transparency, except when you have a 9 lot of mud coming in, sediment, non-algal turbidity 10 appearing in the reservoir. So really the pros and 08:31AM 11 cons, I don't think that I can say one is better 12 than the other, but I will say the State of Oklahoma 13 and just about every other state is using 14 chlorophyll as its best indicator of the condition 15 of a reservoir or a lake. 08:31AM</p> <p>16 Q And why would that be?</p> <p>17 A This is what the public sees is the color of 18 the water, the presence of algal scums and things 19 like this or whether the water has an odor or taste 20 to it, and generally those are all linked to 08:32AM 21 chlorophyll and, of course, chlorophyll is strongly 22 linked to total phosphorus and to transparency, but 23 those are variables you can't see.</p> <p>24 Q Well, is the chlorophyll getting better or 25 worse in Tenkiller Reservoir since let's say '92 and 08:32AM</p> <p style="text-align: center;">319</p>	<p>1 2007 would you attribute to differences in river 2 flows as opposed to changes in total phosphorus 3 loading or biological uptake?</p> <p>4 A It's certainly varied with the year, and I'm 5 looking at Figure 7. If we look at 1992 and 1993 08:34AM 6 with low water residence time, concentration is 7 higher. Then if you look at 2005, 2006, 8 concentration continues to go up and up in Station 9 04. It's much lower at Station 01. So it's 10 responding to the longer water residence time and, 08:34AM 11 therefore, a higher settling rate, but when we come 12 out here to 2008 where we had a wetter year with 13 more runoff and less settling in the reservoir, 14 concentrations are back up again into the eutrophic 15 range. 08:34AM</p> <p>16 Q Well, can you explain how you calculated the 17 residence times shown at the top of your Figure 7?</p> <p>18 A Sure. That's called a half year water 19 residence time, and so we use the summer season to 20 calculate this, the six months of what we call the 08:35AM 21 summer season, so that's the half year, and divide 22 the reservoir volume by that half year inflow.</p> <p>23 Q Where is figure 2008 -- excuse me. Where is 24 the year 2008 number shown on your Figure 7?</p> <p>25 A Well, what I'm using is a supplemental report 08:35AM</p> <p style="text-align: center;">321</p>

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<p>1 that we gave you yesterday, which shows the 2008</p> <p>2 year.</p> <p>3 Q That supplemental report that you -- that</p> <p>4 you're looking at right now --</p> <p>5 A Yes, sir. 08:35AM</p> <p>6 Q -- that's something that you presented or</p> <p>7 handed to us yesterday; is that correct?</p> <p>8 A Yes.</p> <p>9 Q I think you said it was dated November 25th?</p> <p>10 A I believe so. 08:35AM</p> <p>11 Q Of 2008?</p> <p>12 A Let's say late November and that would be</p> <p>13 accurate.</p> <p>14 Q And when was your report submitted in this</p> <p>15 case? 08:36AM</p> <p>16 A This was submitted at the end of May of 2008.</p> <p>17 Q And what you're looking at right now on Figure</p> <p>18 7, which is a part of the packet of new stuff you</p> <p>19 presented us yesterday, that has all been prepared</p> <p>20 since the submission of your original report in this 08:36AM</p> <p>21 case; correct?</p> <p>22 A Well, yeah. These are new data obtained since</p> <p>23 that was submitted.</p> <p>24 Q And the packet of stuff that you presented to</p> <p>25 us yesterday that has new data and new materials in 08:36AM</p> <p style="text-align: center;">322</p>	<p>1 A I believe that's how it reads.</p> <p>2 Q Okay. Now, looking at your total phosphorus</p> <p>3 measurements back on Figure 7, Page 69 of your</p> <p>4 report --</p> <p>5 A Uh-huh, I have it. 08:38AM</p> <p>6 Q You've got that in front of you now, Dr.</p> <p>7 Cooke?</p> <p>8 A Yes.</p> <p>9 Q Don't your lake average values indicate that</p> <p>10 the lake was eutrophic in 1974, 1992 and 1993? 08:38AM</p> <p>11 A Based on total phosphorus, that would be</p> <p>12 correct.</p> <p>13 Q And don't your lake average values also</p> <p>14 indicate the lake switched to mesotrophic in 2005,</p> <p>15 2006 and 2007? 08:39AM</p> <p>16 A Based on total phosphorus, that would be</p> <p>17 correct and, of course, that happened because of</p> <p>18 residence time was so much longer in those years so</p> <p>19 there was a lot of settling by the time the water</p> <p>20 reached the Station LK-01 and 02, and that's the 08:39AM</p> <p>21 reason for that.</p> <p>22 Q But regardless, the lake average values did</p> <p>23 switch to mesotrophic in '05, '06 and '07, did they</p> <p>24 not?</p> <p>25 A Right, for the cause that I had just given 08:39AM</p> <p style="text-align: center;">324</p>
<p>1 it, those aren't corrections of the original work</p> <p>2 you did in this case, are they?</p> <p>3 A No.</p> <p>4 Q It's new data, isn't it?</p> <p>5 A It's new data for 2008. 08:36AM</p> <p>6 Q It's new information, isn't it?</p> <p>7 A Yes.</p> <p>8 Q And are you presenting or did you present that</p> <p>9 to us yesterday at the start of your deposition?</p> <p>10 A Yes. 08:36AM</p> <p>11 Q Okay. Some five months after your original</p> <p>12 report was submitted for the purpose of trying to</p> <p>13 bolster your opinions in this case?</p> <p>14 A Well, all I'm interested in is accuracy here,</p> <p>15 and that's what we get by getting more data, and 08:37AM</p> <p>16 this certainly conforms -- these data certainly</p> <p>17 conform to our understanding of how reservoirs work.</p> <p>18 Q Thank you. Let's look at your second opinion,</p> <p>19 which is on Page 1 of your report in which, Dr.</p> <p>20 Cooke, you say that Lake Tenkiller switched from 08:37AM</p> <p>21 borderline oligotrophic-mesotrophic in 1974-1975 to</p> <p>22 eutrophic by 1976 and remained so through 2007,</p> <p>23 except in 2006 when drought conditions reduced the</p> <p>24 impact of TP-rich river inflow. That's what you</p> <p>25 stated in that opinion, was it not? 08:38AM</p> <p style="text-align: center;">323</p>	<p>1 you, that residence time became so much longer, that</p> <p>2 there was a lot of settling. Drought does not</p> <p>3 improve lakes. It just changes residence time.</p> <p>4 Q Your third opinion on Page 2 of your report</p> <p>5 says that Tenkiller TP appears to be increasing. Do 08:39AM</p> <p>6 you see that? It's the third bullet point.</p> <p>7 A On Page 2?</p> <p>8 Q Yes, sir. It says Tenkiller TP appears to be</p> <p>9 increasing. You got that?</p> <p>10 A Yes, I do. 08:40AM</p> <p>11 Q Let me ask you this then: Tell me what data</p> <p>12 you used to support that opinion.</p> <p>13 A Figure 7 shows a dramatic increase in the</p> <p>14 concentration of total phosphorus at Station LK-04</p> <p>15 every year with the exception of 2007 where it 08:40AM</p> <p>16 dropped and then it comes back up again in 2008. So</p> <p>17 there's a lot of increase here.</p> <p>18 Q What about the other three stations?</p> <p>19 A Other three stations, in Station LK-01 and</p> <p>20 LK-02, that concentration appears to fall, little 08:40AM</p> <p>21 less of a fall in LK-03 and, again, these are tied</p> <p>22 directly to water residence time. This has nothing</p> <p>23 to do with the pollution that's coming in. It has</p> <p>24 everything to do with polluted materials settling to</p> <p>25 the bottom of the reservoir. 08:40AM</p> <p style="text-align: center;">325</p>

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<p>1 Q But what I asked, though, Dr. Cooke, is what 2 land uses contribute to higher phosphorus and 3 nitrogen? 4 A That would be a land use -- 5 Q Yeah, but what others? 10:21AM 6 A -- is using it for disposing. Other land 7 uses, row crop agriculture would do it. 8 Q What else? 9 A Confined animal feeding operation would do it, 10 export from some types of urban areas, particularly 10:21AM 11 parking lots. 12 Q Anything else? 13 A Right now that's all I can think of. 14 Q If you have those sort of land uses but no 15 poultry, can't you still see high phosphorus and 10:21AM 16 nitrogen in reservoirs? 17 A You could if the amount coming off those other 18 types of land uses was really high, was significant. 19 Q Does the Illinois River watershed contain the 20 land uses you just mentioned to me a minute ago in 10:21AM 21 response to my previous question? 22 A They contain those land uses, and as I think 23 about even other land uses, I think there's golf 24 courses, which is a type of land use. There's some 25 residential areas, which would be a type of land 10:22AM</p> <p style="text-align: center;">386</p>	<p>1 MR. PAGE: Well, the report doesn't talk 2 about the last decade, so you had him read something 3 about his report that talks about the total time 4 period. Presumably you've asked him that question, 5 I don't know, and then you tailor your question 10:24AM 6 different than what his report -- 7 MR. BASSETT: But in the report it says 8 it's increasing. 9 MR. PAGE: I know, but it wasn't -- your 10 question -- that's why I thought there was some 10:24AM 11 unclarity or ambiguity was because of the last 12 decade. That was the basis, just that potential 13 ambiguity. 14 Q Do you remember the question? 15 A I think I do. 10:24AM 16 Q Can you show me the data that demonstrates an 17 increase over the past decade in phosphorus 18 concentration in chlorophyll? 19 A Okay. I'll refer you to Figure 7. I don't 20 know whether you want me to hold it up or what you'd 10:24AM 21 like, but you can see bar graph for -- in purple 22 here for LK-04 is steadily going up. 23 Q What about the other three stations? 24 A Other three stations it seems to vary, and it 25 clearly varies based on water residence time. So 10:24AM</p> <p style="text-align: center;">388</p>
<p>1 use, but these were all considered in Dr. Engel's 2 mass balance, and the quantity of phosphorus coming 3 off them, while it's there, it's nothing compared to 4 what's coming off of untreated wastes being put on 5 the slopes of the watershed. 10:22AM 6 Q Look at Page 33 of your report, would you, Dr. 7 Cooke. 8 MR. PAGE: 33? 9 MR. BASSETT: Yes, David, 33. 10 Q It's near the -- I want to go to near the 10:22AM 11 bottom of the third paragraph where you state that P 12 concentrations in chlorophyll-a are increasing. 13 A Okay. Maybe we could indicate the line that 14 you're talking about and I'll start from there. 15 Q It's about five lines up, five lines from the 10:23AM 16 bottom of the third paragraph. 17 A With a line that starts with because? 18 Q Yes. 19 A Okay. 20 Q Can you show me the data in your report that 10:23AM 21 demonstrate an increase over the past decade in P 22 concentration in chlorophyll-a? 23 MR. PAGE: Object to the form. 24 MR. BASSETT: I'm just curious. What was 25 objectionable about that? 10:23AM</p> <p style="text-align: center;">387</p>	<p>1 when we have a drought like 2005, '6 and '7 and so 2 little poultry waste washed off the land and a lot 3 of deposition, no, it doesn't go up in those, but 4 you can go back to 2008, which we talked about 5 yesterday, concentration is right back up there 10:25AM 6 again because we had a low water residence time 7 year. So, again, it's varied on water residence 8 time, but we do definitely have increased 9 concentration of total phosphorus here. 10 Q Didn't you say earlier that there were other 10:25AM 11 factors driving this besides residence time? 12 A Total phosphorus concentration is driven by 13 input and residence time. 14 Q Just for the Record, LK-4 is the riverine 15 section of Tenkiller, is it not? 10:26AM 16 A Correct. 17 Q I'm trying to cut some stuff out here, Dr. 18 Cooke. 19 A Okay. Thank you. 20 Q In Figures 7.1 and 7.2 of your report -- you 10:26AM 21 want to turn to that? 22 A Okay. I have it. 23 Q In Figure 7.1 and 7.2 you claim to show highly 24 significant relationships between water residence 25 time and total phosphorus in Tenkiller Reservoir; is 10:27AM</p> <p style="text-align: center;">389</p>

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